Deactivation and Decommissioning Focus Area

Large-Scale Demonstration and Deployment Project

Implementation Guide

Revision 2

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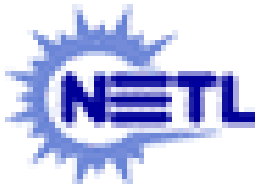

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IMPLEMENTATION GUIDE

Purpose and Scope

The Large-Scale Demonstration and Deployment Project (LSDDP) Implementation Guide is intended to convey the Deactivation and Decommissioning Focus Area (DDFA) philosophy and general guidelines for implementation of its LSDDPs. The Implementation Guide provides the necessary latitude to enable each LSDDP to be implemented in a manner that is consistent with the unique attributes, operational practices, and project management protocols of each site and Department of Energy (DOE) field office and still meet the DDFA performance requirements. The LSDDP Implementation Guide was developed based on existing DDFA program documents and LSDDP lessons learned meetings held in October 1996 and May 1998. Revision 1 of the Implementation Guide is based on updating the guide to include lessons learned from the May 1998 meeting.

Introduction and Background

Deactivation and Decommissioning Focus Area. As one of four major focus areas in the DOE Office of Science and Technology (EM-OST), the DDFA is responsible for developing, demonstrating and deploying cost-effective and safe technologies to deactivate and/or decommission approximately 7,000 contaminated facilities that are currently on DOE's list of surplus facilities. Deactivation refers to ceasing facility operations and placing the facility in a safe and stable condition to prevent unacceptable exposure of people or the environment to radioactive or other hazardous materials until the facility can be decommissioned to its desired end state. Typically, deactivation involves removal of fuel, removal of stored radioactive and other hazardous materials, and draining of systems. Decommissioning is the process of decontaminating or removing contaminated equipment and structures to achieve the desired end state for the facility. Desired end states include complete removal and remediation of the facility, facility entombment, release of facility for unrestricted use, or release of facility for restricted use.

In general, sufficient baseline technologies exist to decontaminate and decommission (D&D) the DOE surplus buildings, structures, and their contents—there are no substantial technology "gaps." Many of these technologies were developed by the nuclear utility industry, which has similar problems to those found within the DOE complex, or the D&D firms that service this industry. In addition, other countries with nuclear weapons and/or nuclear utility programs have developed technologies applicable to D&D problems. However, in general, baseline technologies are often labor intensive, time consuming, expensive, and can excessively expose workers to radioactive and other hazardous materials. Additionally, many baseline technologies also generate secondary waste beyond those of the building materials and their contents.

The DDFA is addressing these problems by developing, demonstrating, and facilitating deployment of technologies that generate less secondary waste, are lower in cost, require less labor, reduce exposure of personnel to radioactive and other hazardous materials, and improve worker safety. Innovative technologies are being developed for characterization of contamination, decontamination of buildings and materials, dismantlement of buildings and equipment systems, reuse or recycle of materials, waste minimization, and worker protection and safety.

Ultimately, the end goal of any technology development program is to commercialize the technology so that it will provide quantifiable benefits to potential end users in terms of cost savings, radiation dose reduction, waste volume reduction, schedule acceleration, and safety improvements. A key phase of technology development in the DDFA is "demonstration" of the technology to these potential end users. Technologies reaching the demonstration stage should have clear end user support for the demonstration; firm cost-sharing arrangements and partnership agreements; and resolution of technical, safety, regulatory, public, and intellectual property issues. It is the intent of the DDFA to conduct technology demonstrations in DOE facilities at a scale and test duration that is convincing to potential end users. Data from demonstration of the technology should provide potential end users with sufficient information needed to make decisions regarding subsequent use of the technology. Primary end users for

DDFA technologies are the DOE Offices of Waste Management (EM-30), Environmental Restoration (EM-40), and Nuclear Materials and Facilities Stabilization (EM-60). The Office of Waste Management (EM-30) is a potential end user as the beneficiary of waste minimization and recycling technology. EM-40 is responsible for decommissioning DOE surplus facilities, while EM-60 is responsible for deactivation of these facilities.

Large-Scale Demonstration and Deployment Project Concept. The DDFA has observed that its EM-30, EM-40, and EM-60 customers are often unwilling to accept the risk and liability associated with the first time use of an innovative or improved technology. In order to comprehensively evaluate the cost and performance of these innovative/improved technologies, the DDFA has embarked upon a strategy—the LSDDP concept—to sponsor these first-time, full-scale demonstrations within the DOE complex, whether the technology originates within the DDFA, other DOE offices and programs, or in the commercial sector. The fundamental requirements are that LSDDPs be performed as part of actual D&D projects, and that the problem-holder commit to further deploy the technology within that project if its cost and performance merit such deployment. The intent of the LSDDPs is to demonstrate the potential advantages of the innovative/improved D&D technologies over baseline technologies. This is effectively accomplished by demonstrating and evaluating innovative/improved D&D technologies side-by-side with baseline technologies in an ongoing project.

An Integrating Contractor (IC) Team manages the technology aspects of each LSDDP and oversees the work of the subcontractors who own the innovative/improved and baseline D&D technologies. The IC Team, typically consisting of three or more experienced D&D firms, evaluates the performance of both the innovative/improved and baseline technologies, as demonstrated in the LSDDP. The D&D service providers will be able to use the demonstrated technologies in performing future D&D work at other DOE sites and commercial nuclear facilities. Participation by multiple D&D firms ensures a balanced approach to D&D of the DOE surplus facility, since different firms may use different baseline and innovative/improved technologies and may have different perspectives on the risks associated with the use of innovative/improved technologies. In addition, knowledge of the innovative/improved technologies used in the LSDDP will be directly transferred to more D&D firms.

Through an interagency agreement, the DDFA has acquired the services of the United States Army Corps of Engineers (USACE) to provide an independent cost effectiveness analysis of each technology demonstrated during a LSDDP. This ensures that the cost and benefit analysis for each LSDDP is performed on a consistent basis. Comprehensive cost and performance data from these side-by-side demonstrations are published in Innovative Technology Summary Reports (ITSR), sometimes known as "Green Books." The ITSRs provide a summary of the results of the technology demonstrations. Full details of the results of the demonstrations, including raw data and calculations, are documented in Detailed Technology Reports (DTR).

Current Large-Scale Demonstration and Deployment Projects. In October 1995, the first three LSDDPs were selected. Selection was based on proposals received in response to a Request

for Letter Proposal issued by the Federal Energy Technology Center, on behalf of the DDFA, in June 1995. These LSDDPs were:

(1) The Chicago Pile-5 (CP-5) research reactor at Argonne National Laboratory-East near Chicago, Illinois
(2) The Plant-l uranium processing complex at the Fernald Environmental Management Project near Cincinnati, Ohio
(3) The 105-C production reactor at the Hanford Reservation near Richland, Washington

These three LSDDPs will end in FY 1998. A second Request for Letter Proposal was issued by the DDFA to all DOE Operations Offices on May 1996, inviting them to offer facilities under their custody for the purpose of conducting an LSDDP. Fourteen letter proposals were received by July 29, 1996. The letter proposals were evaluated by a team of Federal employees according to evaluation criteria described in the Request for Letter Proposals and procedures established in an evaluation plan. Four LSDDPs— numbered four through seven—were selected for initiation in March 1998. These LSDDPs are:

- LANL TRU Waste Characterization, Decontamination, and Disposition
- Mound Tritium Facilities
- Savannah River 321-M Fuel Fabrication Facility Deactivation
- INEEL Fuel Storage Canals and Associated Underwater and Underground Facilities

Goals of the Large-Scale Demonstration and Deployment Project Program. The DDFA goals for LSDDPs include the following:

- All technology demonstrations funded by the DDFA will occur in LSDDPs. The DDFA will address 90 percent of D&D needs identified by EM-30, EM-40, EM-60, and the Site Technology Coordinating Groups in nine LSDDPs. To meet the 90 percent goal for addressing DOE problem areas, and demonstrate innovative/improved technologies on the most prevalent and urgent D&D problems/needs, the DDFA will diversify selection of LSDDPs among the following types of facilities:

  – Gaseous Diffusion Plants
  – Tritium Processing Facilities
  – Plutonium Processing Facilities
  – Uranium Processing Facilities
  – Lithium Processing Facilities
  – Spent Fuel Reprocessing Facilities
  – Weapons Assembly/Disassembly Facilities
  – Laboratory Facilities, including hot cells and gloveboxes
  – Research and Test Reactors
  – Production Reactors

  - Fuel Storage Pools

- The LSDDP will have a significant impact, such as visible skyline changes and reduction in cost, time, and safety and health risks for the project.

- The LSDDP should assess the significant potential benefits of using a suite of innovative/improved technologies compared to baseline technologies. The suite of technologies should address technology needs in characterization, deactivation, surveillance and maintenance, decontamination, dismantlement, worker protection and safety, and material disposition and recycling of the DOE's surplus buildings, structures, and their contents.

- The LSDDP will be conducted at a scale that is convincing to the potential end-users of the benefits of the innovative/improved technologies (i.e., EM-30, EM-40, EM-60, and others). The LSDDP will assist the DOE Operations and Field Offices in accomplishing its ongoing and planned D&D activities.

- Several D&D service firms will participate on each IC Team and will transfer the experience and expertise gained to similar D&D projects at other DOE and commercial facilities.

Large-Scale Demonstration and Deployment Project Implementation Management

Management of Large-Scale Demonstration and Deployment Projects. LSDDPs are managed by DOE-FETC in coordination with the responsible DOE Operation or Field Office. The IC Team, lead by the Adminstrating Contractor, subcontracts with firms who own the innovative/improved D&D technologies to be demonstrated in the LSDDP. Typically, the Administrating Contractor awards and manages the subcontracts. D&D firms on the IC Team should generally be willing and able to bid on and perform D&D work at other DOE facilities and commercial nuclear power plants. They should be willing and able to use the innovative/improved D&D technologies provided that the technologies prove their advantages in demonstrations during the LSDDP.

Funding Guideline. The DDFA envisions contributing about $2-5 million over the duration of a LSDDP, providing there are sufficient opportunities to demonstrate innovative/improved technologies during the project. The cost of the LSDDPs is shared by the DDFA (EM-50), and to varying degrees, vendors of the innovative/improved technologies. Normally, the facility owner is EM-40 for decommissioning projects and EM-60 for deactivation projects. In general, the project costs associated with demonstration of the innovative/improved technology and collection of data during demonstration of the innovative/improved technology and the baseline technology are provided by the DDFA, while costs associated with the operation of the baseline technology during its demonstration period are provided by either EM-40 or EM-60. A vendor of an innovative/improved technology is expected to share the cost of their demonstration in return for a rapid avenue to commercialization, the DOE D&D market, and acceptance by the end users, regulators, and other stakeholders. Funds may also be contributed from other sources, such as the private sector, other DOE offices, and other Federal and State agencies.

Proposed Schedule Guideline. It is the DDFA's intention that LSDDPs be completed in no more than two years to promote progression through the various facility types and new problem sets described in the LSDDP background above. The DDFA plans to start two new LSDDPs in FY 2000 and maintain two or three in progress at any one time to match available funding. Field work on the last LSDDP is expected to be completed by the end of FY 2002.

Discussion Points. Issues which affect the development of the project management concept are provided below.

- **Program Planning and Budget**- Funding for individual LSDDPs is programmed in the Program Execution Guidance (PEG) and appropriated through the EM Financial Plan. A Technical Task Plan (TTP) is prepared by the Principal Investigator using the appropriate software and the PEG, and approved by the cognizant Technical Project Officer and the DDFA Project Manager before going to headquarters. The TTP serves as a contract between the DDFA Project Manager and the Principal Investigator for execution of the project according to LSDDP program guidance. In addition to the approach to program execution, the TTP specifies the milestones, spending plans, performance measures (e.g., number of demonstrations, cost-sharing, etc.), deliverables, and reporting requirements.

- **Baseline Cost and Schedule**- To ensure the technology demonstrations are adequately integrated with baseline activities, the Administrating Contractor and the Principle Investigator should ensure that the LSDDP milestones are included in the baseline Project Master Schedule, and that each demonstration is included in the Integrated Project Baseline Schedule. Milestones and spend plans should consider the schedules of the current projects, which suggest that project progression is not linear—most demonstration activity occurs during the later stages of the project. The CP-5 LSDDP received $5.25 million of DDFA funds and commenced in October 1995. Fernald Plant-1 LSDDP received $3.1 million of DDFA funds and commenced in January 1996. Hanford

C-Reactor LSDDP received a total of $8.0 million from the DDFA including $1.0 M in FY96 for project startup and planning, but did not officially begin until October 1996. Based on the experience of these three LSDDPs, the nominal spending profile should reflect six to nine months of spending proportional to project planning, technology selection, and demonstration planning. However, it is expected that new LSDDPs will benefit from the experiences of the first three LSDDPs and be able to expedite attaining the first field demonstration in four to six months after the start of the project. The length of the planning period and opportunities for demonstration may also be influenced by the progress of the baseline D&D project. Particular consideration should be given to constraints of fiscal year timing. As they are currently structured, LSDDPs are funded on a fiscal year basis and must comply with limits on spending and uncosted carryover.

- **Performance Measures-** Typical performance measures for LSDDPs include total number of demonstrations; number of technologies transferred to the baseline project; number of technologies deployed by DOE and others, including those deployed by the Accelerated Site Technology Deployment Program; percentage of project funding provided to technology vendors; percentage of funding for project management activities; percentage of cost sharing by technology vendors; and actual and potential cost savings and other benefits of innovative/improved technologies through deployments following successful demonstrations. The number of demonstrations refers to the number of innovative/improved technologies demonstrated and does not include the demonstration of baseline technologies. Baseline technologies are considered part of the baseline D&D project. The metric regarding funding to technology vendors is provided to influence the IC Team to focus resources on technology demonstrations and not project management.

- **Role of the Integrating Contractor Team**- The IC Team is expected to be the central body managing the technical aspects of the LSDDP. The role of the IC Team in the LSDDP extends from its inception until the final report is approved for publication. Their responsibilities include identification of technology needs and problems for the baseline project; interaction with stakeholders; screening and selection of innovative/improved technologies for demonstration; development of baseline and innovative/improved technology demonstration test plans and success criteria; integration of demonstrations into the baseline D&D project; evaluation of results of innovative/improved and baseline technology demonstrations; preparation of a Technology Demonstration Factsheet, DTR, and ITSR for each demonstration; preparation of project final report; and communication of results including technical papers and presentations, exhibit booths, Internet LSDDP homepages, video documentaries, live demonstrations, and open houses. Furthermore, members of the IC Team are expected to include successful innovative/improved technologies in bid proposals submitted by their firms for future D&D projects. The following list contains expectations which have been conveyed to previous IC Teams:

  - The IC Team is responsible for integrating and balancing the needs of the baseline project with the full-scale demonstration of innovative/improved technologies. This responsibility provides for the comprehensive demonstration of selected innovative/improved technologies while preventing an adverse impact on the budget and schedule of the baseline project.

  - The IC Team is responsible for screening and selection of innovative/improved technologies for demonstration in the LSDDP using a set of established evaluation criteria. The IC Team is responsible for documenting the results of each technology that is screened for possible demonstration.

  - The IC Team is responsible for ensuring that all innovative/improved technologies selected support a need of the baseline D&D project. The innovative/improved

technology must complete a portion of the baseline decommissioning work during its demonstration.

- The IC Team is responsible for ensuring that each innovative/improved technology selected for demonstration in the project is directly compared to an appropriate baseline technology.

- In conjunction with the U.S. Army Corps of Engineers, the IC Team is responsible for evaluating and reporting cost and performance of innovative/improved and baseline technologies and preparing an ITSR for each demonstrated technology. The IC Team will also prepare a DTR, which provides all details of the technology demonstration and forms the basis for preparation of the ITSR. The main purpose of the ITSR is to provide the D&D project manager with credible and validated information on the field performance of the baseline and innovative/improved technologies to assist in selection of the optimum set of technologies for a specific D&D project.

- The IC Team is responsible for communicating the results of the innovative/improved technology demonstrations, including both cost and non-cost factors (e.g., radiation dose, safety features, schedule impact, and regulatory and stakeholder acceptance). Communications will be achieved primarily through an Internet LSDDP homepage and the ITSRs. However, each IC Team member is encouraged to prepare and present papers at conferences and meetings. Additional avenues for communication of results includes a one or two-page Technology Demonstration Factsheet containing preliminary demonstration results within two weeks after a demonstration, LSDDP open houses with live technology demonstrations, video documentaries, and conference exhibit booths. Each IC Team member should also facilitate technology transfer through their parent company or organization.

- The IC Team is responsible for documenting lessons learned from implementation of their LSDDP to assist future and current IC Teams.

- The IC Team is responsible for participating in the DDFA's Mid-Year Review Meeting and any peer review meetings.

- **Role of the Principal Investigator and Administrating Contractor (or Equivalent)**- Within the IC Team, the Principal Investigator (PI) and the Administrating Contractor are expected to provide financial management and overall coordination and logistic support. The PI and Administrating Contractor are responsible for development of the TTP and reporting in the Project Tracking System (PTS). The PI and Administrating Contractor are responsible to the DDFA for budget management, and must interact with the other IC Team members to ensure that the LSDDP stays within financial targets. Other deliverables include a Test Plan, Technology Demonstration Factsheet, DTR, and ITSR for each demonstration. Also, deliverables should include a Project Management Plan and Communication Plan at the onset of the LSDDP, creation and maintenance of a LSDDP website, LSDDP exhibit booth, a video documentary at the conclusion of the project, and a project final report.

  By the 10th of each month, a monthly status report must be submitted which reports on the previous month's activities including the technical, budget, and schedule/milestone status of the project. Typically, the monthly status report includes a project objective and defines work elements which do not change on a monthly basis; an update to the project schedule and milestones reflecting planned, revised, and actual dates for achievement of milestones and reasons for any variances; and budget status including monthly and cumulative reporting on budgeted cost of work scheduled, actual expenditures of funds,

variances, and reasons for any variances. The technical status should report on significant events, status of work elements, plans for the next 30-60 days, issues and concerns, and status of technology demonstrations and deliverables associated with demonstrations.

- **Role of the DDFA and Site DOE Representative** - The DDFA and the cognizant DOE project manager at the site provide broad project direction without unduly influencing the decision processes of the IC Team. Their guidance will be focused toward meeting the DDFA and site objectives. Both the DDFA and DOE Operations/Field Offices have access to substantial innovative/improved technology databases and information resources and may participate in the IC Team process. Ideally, the DOE project manager at the site who is co-managing the IC Team with the DDFA project manager on the LSDDP is also the DOE project manager for the baseline project.

- **Role of the USACE**- The USACE has been contracted by the DDFA to develop cost estimates for the baseline and innovative/improved technologies demonstrated in all LSDDPs. Since the USACE has no vested interest in any demonstrated technology, they can provide an independent and consistent approach in developing the cost estimates. The USACE will participate in development of the demonstration test plans to ensure that the appropriate data is collected during the demonstration. As necessary, they will witness the demonstrations or collect data during the demonstrations. The USACE and the Test Engineer review the demonstration data and decide on the values and underlying assumptions that need to be incorporated into the cost estimate. The USACE uses the Microcomputer-Aided Cost Estimating System (MCACES) cost estimating software, which was developed by multiple government agencies. They also use the Hazardous, Toxic, and Radioactive Waste Remedial Action Work Breakdown Structure to organize categories of D&D activities. The USACE prepares the cost section of the DTRs and a draft of the Section 5 cost analysis in the ITSRs. Typically, the USACE will summarize the cost analysis by presenting a graph of estimated life-cycle cost versus quantity of work for the baseline and innovative/improved technologies over the range of quantity of commercial D&D work (i.e., breakeven chart). Also, a graph which depicts the contribution of individual cost drivers (e.g., mobilization, D&D work, waste disposal) to the overall estimated cost for the baseline and innovative/improved technologies are generated. Unit costs (e.g., $ per sq ft) are also reported for both the innovative/improved and baseline technologies based on amortization of capital costs and D&D work.

- **Role of Other DDFA Contractors**- The DDFA has access to several technical support contractors that could make contributions to the LSDDPs. Typically, the technical support contractors assist in communication of technology demonstration results, and in maintaining consistency among all LSDDPs in regards to approach, data collection, and development of ITSRs.

- **Role of Technology Vendors**- Innovative/improved technology vendors can participate in the LSDDP in several ways. The decision on whether the technology vendor or baseline D&D service organization should operate the technology during the demonstration depends on several factors. The most important factor is the technology vendor's preferred approach to provide the technology on a commercial basis. If possible, the operator during the technology demonstration should be the same as the operator during commercial use of the technology. Commercial options include D&D service, sale of a product, or short-term rental of equipment. Other factors involved in this decision include technology training requirements, site-training requirements, and skill of personnel.

  Thus, roles for the technology vendor during the demonstration can include operation of equipment, worker training, observer, and technical consultant.

  Another concern that should be addressed is the issue of liability for equipment which

has been contaminated and which cannot be successfully decontaminated. This issue is covered more completely in the Technology Demonstration Process section.

Large-Scale Demonstration and Deployment Project Organization. Each of the first three LSDDPs has been organized and effectively managed using different approaches. The organization diagram of each is included in Appendix A. However, the organization of a LSDDP is not prescribed and should be adapted to best meet the needs and requirements of each project and its IC Team.

Technology Selection Process

DDFA Philosophy and Objectives. Each IC Team should develop an objective, consistent, and documentable process to select innovative/improved technologies for demonstration. The process should ensure that the baseline project is objectively and comprehensively evaluated for problems or needs where a technology can make an impact. Furthermore, the process should provide for the objective evaluation of potential technical solutions to address these problems and needs. In addition to meeting project-specific needs, evaluation of innovative/improved technologies should consider their maturity (i.e., readiness for meaningful demonstration at full-scale), cost of demonstration, broad applicability to other sites, vendor interest (i.e., cost-share, commercial readiness), ability to measure technology performance, potential cost and other benefits, and compatibility with baseline D&D project schedule. Once candidate technologies are identified, the IC Team should address an appropriate method to contact a vendor. Successful technologies should demonstrate benefits when compared to baseline technologies, including but not limited to:

- Lower life-cycle cost-which includes all cost aspects of using the technology, including but not limited to mobilization, demobilization, waste disposal, PPE requirements, etc.
- Lower health and safety risks to the worker and the public
- Lower risks for detrimental impact to the environment
- Reduced quantity of waste materials requiring disposal
- Reduced amount of secondary waste
- Reduced hazard level and category of waste
- Increased reuse of materials within DOE and/or free release of materials for recycle by the private sector
- Accelerated D&D schedule
- Reduced amount of residual contamination in materials following decontamination
- Reduced cost or worker exposure in surveillance and maintenance of facilities

Discussion Points. Issues related to the technology selection phase of the LSDDP are described below.

- **Development of Technology Needs**- Development of technology needs results from a comprehensive and consistent analysis of the baseline D&D project. The process is comparable to value engineering of the project design where all aspects of the planned baseline project are evaluated for potential improvements in cost, schedule, and risk to the environment and the workforce. Technology needs should be as specific as possible to the facility's problem and prescribed in terms of the objective or outcome rather than prescribing a particular technology. For example, rather than prescribing the need for a dry ice decontamination technology, the specification should be for a technology to decontaminate metal contaminated with enriched uranium. The latter significantly broadens the domain of potential solutions. In addition, the baseline approach should be identified and its performance characteristics should be described to enable innovative/improved technology vendors to fully understand the competing baseline technology. The desired performance characteristics of the innovative/improved technology and the desired end state should be fully described.

- **Sources of Technologies**- Once the technology needs and problems of the baseline D&D project have been established, the IC Team should proceed to screen a wide range of technologies to address project needs. There are many sources of innovative/improved technologies and the IC Team should consult the DDFA for technology information references. The DDFA will suggest potential innovative/improved technologies whenever appropriate. Other technology sources include the Technology Information System developed by the Hemispheric Center for Environmental Technology (HCET) at Florida

International University (FIU) and the TechKnow™ database, developed by the Global Environmental Technology Foundation. Some LSDDPs had success with Expressions of Interest published in the Commerce Business Daily (CBD). IC Teams that wish to use the CBD should include additional time during initial project planning and scheduling, since the CBD announcement and response process tends to require additional lead time. An example CBD announcement soliciting technologies for demonstration is included in Appendix B.

- **Baseline Technology**- Each technology or group of technologies demonstrated on a particular problem must, where practicable, be demonstrated side-by-side with an existing baseline technology. This is a central element in the LSDDP to generate meaningful cost and performance information. Side-by-side demonstrations are essential to fairly compare the innovative/improved technology against the baseline method. Historical data and company literature have proven to be unreliable for developing a cost estimate for a baseline technology. Actual demonstration of the baseline technology has proven to be essential for developing its realistic cost effectiveness analyses. The baseline technology is the technology or approach that the D&D contractor would use to address a particular need or problem in the facility and was included in its D&D plan. Normally, D&D contractors will only use a baseline technology with known performance characteristics, despite the potential for less-known technologies to perform better than the selected baseline technology.

- **Innovative/Improved Technology**- Innovative/improved technologies eligible for demonstration in a LSDDP includes:

  – Technologies under development by DOE or the private sector that have reached a stage of maturity where they are ready for full-scale demonstration in an actual D&D project

  – D&D technologies which any site in the DOE complex is not using as baseline technologies

  – New applications of commercial technologies

  – Commercial technologies used in the nuclear utility industry or other market sectors, including non-nuclear markets, but have not been deployed within DOE

  The DDFA encourages the demonstration of both international and domestic technologies in its LSDDPs.

- **Full-Scale Demonstration Ready**- LSDDPs should demonstrate technologies at a scale meaningful to potential end users. To perform in a side-by-side demonstration against baseline, the innovative/improved technologies should be engineered for full-scale operation, including ergonomic efficiency. Premature demonstration of technologies which are not properly engineered for full-scale operation may reflect poorly on their potential to improve cost, performance, or risk measures on future DOE projects. The logistical scale of the demonstration (e.g., the amount of material or surface area) should be large enough to be convincing to potential end users, while not being excessively time consuming or expensive. The scope, scale, duration, location, and schedule of the demonstration is defined by the IC Team. It is important to arrange the side-by-side demonstrations of the baseline and innovative/improved to be as equal and fair as possible. The demonstration must generate conclusive and valid data on the baseline and innovative/improved technologies to assist D&D managers in selecting optimal

technologies for inclusion in D&D plans.

- **Applicability to Other Sites and/or Other Projects**- Applicability to other sites and/or other projects is an important criteria for technology selection, as this indicates the potential return-on-investment for an individual technology demonstration. Early identification of the breadth of applicability of a technology assists the developer and DOE to identify paths for deployment and commercialization of the technology.

- **Evaluation Criteria**- The IC Team should develop a set of criteria by which technologies are consistently screened for applicability to project technology needs. Previous demonstration projects have had success screening a large number of technologies using a two-tiered approach. The first tier includes Go/Stop criteria where all criteria must be a "Go" to move the technology to the second tier of criteria. Examples of Go/Stop criteria could include compatibility with baseline schedule and meeting a project need. The second tier includes more objective criteria that can be scored and weighted. In addition to Go/Stop criteria and scoring, each criteria includes an area on the form for written documentation to support the Go/Stop or score.

- **Technology Selection** - Innovative/improved technologies are selected for demonstration using an IC Team voting process. Typically, each organizational member of the IC Team has one vote. Some IC Teams have selected innovative/improved technologies for demonstration based on requiring a voting or consensus process.

  Sometimes, it is necessary to develop a demonstration proposal before a final decision is made on selecting a technology for demonstration. The demonstration proposal outlines the scope, scale, duration, location, and schedule of the demonstration to enable the IC Team to discern whether there are any substantial issues on the value of the demonstration. For example, these issues could include ability to arrange a fair comparison, ability to adequately measure technology performance, and accessibility concerns. Examples of the technology screening criteria are presented in Appendix C.

Technology Demonstration Process

DDFA Philosophy and Objectives. LSDDP demonstrations are conducted as part of a baseline D&D project. Demonstrations are performed side-by-side with designated baseline technologies at a scale that is convincing to the potential users of the innovative/improved technologies (i.e., EM-30, EM-40, EM-60, D&D firms, including those on the IC Team, and others). Because LSDDPs must assist the DOE Operations/Field Office in accomplishing its ongoing and planned D&D activities, technology demonstrations must accomplish a meaningful portion of the baseline D&D project. Data from demonstration testing of the technology should provide end users with pertinent cost and performance information needed in making decisions regarding subsequent use of the technology. The results of individual technology demonstrations will be reported in ITSRs.

Discussion Points. Issues related to the technology demonstration phase of LSDDPs are described below.

- **Cost-Sharing and Negotiation Process**- Technology developers are expected to share the costs of the LSDDP demonstration. Developers are expected to benefit substantially from the exposure to end-users and product advertising which is inherent in the LSDDP. Loan of equipment to be demonstrated by the vendor and labor support are common forms of cost-sharing. Experience from the C-Reactor LSDDP suggests that a competitive bid process is effective in achieving both cost-sharing and cost-efficiency from potential vendors. In addition, the DDFA is encouraging the IC Team to award two-phase contracts to innovative/improved technology vendors. The first phase is for the technology demonstration which includes cost-sharing from the technology vendor. The optional second phase is for continued use of the technology in the facility, if results of the demonstration prove that the innovative/improved technology is more cost-effective or otherwise superior to the baseline technology. The LSDDP will pay for the first phase of the contract, while the facility owner pays for the second phase. In essence, award of the second phase causes the innovative/improved technology to become the new baseline technology for the site.

- **Funding for Technology Demonstrations**- Most LSDDPs have a performance measure which requires that a substantial portion of the project funding be used for actual technology demonstrations. Costs for project management and reporting, demonstration planning, monitoring and data collection, and data analysis are important, but need to be kept to a minimum to maximize the number and scope of technology demonstrations.

- **Sole-Source Procurement versus Competitive Bid**- Each IC Team will have to determine the most efficient means to procure the equipment and/or services of a technology developer for demonstration. For most cases, the Federal Acquisition Rules (FAR) apply and the procurement must be competitively bid. Because some of the technologies will only be available from a single vendor, a sole-source procurement may be justified. In the case where the demonstration will be subcontracted through a D&D contractor performing the baseline D&D project, the contractor can avoid complicating FAR requirements when he is complying with a performance-based modification to a fixed-price contract. The Strategic Alliance formed for the CP-5 LSDDP has negotiated relief from a number of the FAR requirements to be able to perform under their Financial Assistance Agreement with the DOE. Where the technology is available from two or more vendors or service providers, the IC Team should use the advantage of a competitive procurement to obtain cost-sharing and increase response.

- **Demonstration by Site D&D Personnel versus Technology Vendor**- The IC Team must decide which organization will demonstrate each technology. The most important factor in this decision is the technology vendor's preferred approach to provide the technology on a commercial basis. If possible, the operator during the technology demonstration should be the

same as the operator during commercial use of the technology. Commercial options include D&D service, sale of a product, or short-term rental of equipment. Other factors involved in this decision include technology training requirements, site-training requirements, local work rights issues, product liability, technology maturity (e.g., full-scale prototype or commercial equipment), and skill of personnel. In some cases, demonstration of the technology by both the technology vendor and the D&D crew would provide useful information on the learning curve for the technology. One LSDDP has used this approach effectively for robotic technologies.

In the case where the site D&D crew operates the equipment, the innovative/improved technology vendor will benefit from the feedback of the workers operating the equipment. For example, workers often modify the equipment to improve its ergonomics in the field.

- **Side-by-Side Demonstration against Baseline**- The DDFA philosophy requires that innovative/improved technologies be demonstrated side-by-side with the baseline competitor. Demonstration in this mode ensures a fair comparison of the new technology and meaningful cost and performance data for distribution throughout the DOE complex. Simultaneous, or near simultaneous, demonstration on identical, or comparable, surfaces or areas mitigates performance differences caused by variations in environmental conditions, data collection, or performance interpretation. Cost and performance estimates for baseline technologies which rely on documented cost estimating factors contain inherent assumptions and safety factors which inhibit meaningful performance comparisons.

- **Large-Scale Criteria (Learning Curve)**- To generate meaningful cost and performance information, the innovative/improved and baseline technologies must first be operated through a start-up and familiarization period. Despite the best intentions and efforts of everyone involved, problems are routinely experienced during mobilization, initial start-up, and crew training. Additionally, the operating crew will identify improvements to the design and operation of a technology which will enhance the performance well beyond what the developer had envisioned. To complete a meaningful demonstration, the IC Team must ensure that the technology demonstration allows for sufficient time and test area to overcome this increased "learning curve" and attain an optimal performance rate based on the state of full-scale engineering of the technology. The IC Team should also consider a contingency in the contract with the developer to allow for additional operating time if the technology shows the potential for enhanced performance. Conversely, the IC Team should not elect to demonstrate a technology if there is insufficient scope of work in the baseline project to complete a meaningful demonstration of both the baseline and innovative/improved technologies.

- **Successful Demonstration**- A successful demonstration is defined as one where both an innovative/improved and baseline technology have been demonstrated under comparable conditions and over adequate area or scope, and where sufficient cost and performance data have been collected to complete a meaningful cost and performance evaluation. Note that the success of the demonstration does not depend on the superior performance of the innovative/improved technology. While the expectation of superior performance is a necessary condition for the selection of the technology for demonstration, the objective of the demonstration is to test that hypothesis.

- **Demonstration Test Plan and Data Collection**- To complete a successful demonstration, the IC Team must ensure that all the necessary cost and performance data are collected. Therefore, the IC Team should invest adequate resources in demonstration planning and data collection. DOE's Federal Energy Technology Center (FETC) has contracted with the USACE to complete uniform cost analyses of each technology demonstrated under the LSDDP. They must be included in the planning phase of the demonstration to ensure that their data collection requirements are met. The demonstration test plan should consider all the circumstances which affect performance of both the baseline and innovative/improved

technologies and forecast data collection equipment, analytical requirements, and labor. The example test plan developed for the Fernald LSDDP is presented in Appendix D. The C-Reactor IC Team implemented a Data Quality Objectives Process and a Readiness Review as part of their demonstration planning.

- **Cost-Performance Data Manipulation/Interpretation**- FETC has partnered with the USACE to complete the cost and performance assessment of each technology demonstrated under the LSDDP. The USACE has expertise in cost and performance estimating as a function of their work in civil projects around the world. They will use their standardized Microcomputer-Aided Cost Estimating System (MCACES) and HTRW Work Breakdown Structure (WBS) accepted by the Federal Remediation Technologies Roundtable for uniform reporting of environmental technology performance. The effectiveness of the USACE cost and performance assessment methodology is dependent on the formulation of a typical D&D job scenario for the technology and collection of proper data during the demonstration. The IC Team must work closely with the USACE to ensure that the USACE data collection requirements are integrated in the demonstration planning process and are provided to the USACE expeditiously following the demonstration. The USACE WBS and model cost analysis format are presented in Appendix E.

- **Demonstration Reporting**- The effective communication of demonstration results is one of the most critical aspects of the LSDDP. The results of the demonstration must be conveyed in a format which is readable and meaningful to prospective end-users of each technology. The vehicle selected by DOE EM-50 for documentation of final demonstration performance of innovative/improved technologies is the ITSR. This is a formatted document which will include a summary of the cost and performance information on both the innovative/improved technology and the baseline technology to which it is being compared. This information is collected during the demonstration and analyzed by the USACE. The IC Team is responsible for delivering a draft and final ITSR for each innovative/improved technology demonstrated as part of their project. The IC Team must submit a complete draft, including the USACE input, for review by the DDFA and eventual publication through the Government Printing Office. Additionally, because the ITSR is only a summary document, the IC Team is responsible for the completion of a DTR of each demonstration which includes all the data and backup calculations for information presented in the ITSR. The ITSR development responsibilities and format are presented in Appendix F. An example of a published ITSR and DTR are presented in Appendices G and H, respectively. In addition, the IC Team is responsible for preparing and distributing a one- or two-page Technology Demonstration Factsheet within two weeks after the demonstration which describes the innovative/improved technology, its application, and any preliminary demonstration results. A sample of a Technology Demonstration Factsheet can be found in Appendix I.

- **Performance Assessment**- The results of each demonstration should be evaluated and reported objectively. The IC Team should ensure there is adequate scope, scale, and duration of the problem to overcome the "learning curve" discussed previously. This will provide more meaningful cost and performance data that can be used by the end user in evaluating a technology. The IC Team should also consider and comment on the potential for further enhancements of the technology which may improve the cost or performance beyond what is reported.

- **Technology Transition into Baseline Project**- The strongest statement a site can make about the performance of an innovative/improved technology is to incorporate the technology into the baseline project and adapt it as the new site baseline for all future, applicable D&D work. This should be the goal of the IC Team for each successfully demonstrated technology which has cost and performance improvements over the project baseline technologies. Arrangements can be made with technology vendors whereby the vendor would have the option to complete the project with the innovative/improved technology, if it is superior to the baseline technology in the demonstration. This type of arrangement could help to obtain up-front cost-sharing funds from the vendor.

- **Responsibility for Technology Decontamination and Release**- Every component which is moved into a radiological area must be characterized and decontaminated, if necessary, before it can be released for unrestricted use or transfer. The controlling organization at a site can have locally enforced requirements which exceed the DOE Radiological Control Manual and DOE Orders. The IC Team must consider all the requirements which may be applied to an innovative/improved technology and the potential that all or some of the equipment may not be releasable following the demonstration. Each site must define which party will be liable for equipment which cannot be released. While a developer should consider decontamination requirements when designing a technology, developers are sometimes small businesses which cannot sustain the full financial burden of unexpected circumstances.

- **Lessons Learned Documentation**- During the course of their periodic meetings, the IC Team should assess the problems and issues affecting the progress of the LSDDP. Documented analysis of these problems and issues and the successful approaches to overcoming them is of value to the DDFA and other IC Teams. In addition, the DDFA intends to periodically conduct Lessons Learned workshops with IC Teams from ongoing LSDDPs to enable the IC Teams to benefit from each others struggles, and successes.

Communication/Documentation

Interaction with stakeholders and communication of LSDDP activities and demonstration results is essential to moving promising innovative/improved technologies into baseline D&D projects throughout the complex.

DDFA Philosophy and Objectives. Each LSDDP is required to prepare a Communication Plan which integrates the IC Team activities for the entire project. The Communication Plan should include, but is not limited to:

- Specific approaches to communicate project status, progress, issues, and accomplishments with other LSDDPs, the DOE weapons complex, regulators, and tribal and public stakeholders
- Internet home pages for LSDDPs-an example is presented in Appendix J
- Approach to prepare Detailed Technical Reports on demonstrated technologies
- Approach to prepare ITSRs on demonstrated technologies
- Approach to prepare Technology Demonstration Factsheets on demonstrated technologies
- Update of EM-40 Preferred Decommissioning Technology Guide
- Video recording of technology demonstrations
- Video dissemination of project information
- Participation in video conferences or conference calls
- Participation in public meetings and conferences to discuss LSDDPs including the DOE National Decommissioning Meeting, Technical Information Exchange Meetings, American Nuclear Society, and Waste Management and Environmental Restoration annual conferences.
- Preparation and distribution of technical publications, papers, and reports.
- Information databases, for example, technology and vendor data for screened technologies (accepted and rejected)
- News releases
- LSDDP Exhibit booth
- Distribution list and frequency for all forms of communication on LSDDPs including DOE Headquarters and field personnel, contractor personnel, commercial D&D firms, commercial nuclear utilities and the public.

Communication Plans. Communication plans from the first three LSDDPs are presented in Appendix K. Each of these plans includes a comprehensive analysis of the communication process and synthesis into an action plan. Typically, the IC Team Communication Plan identifies the plan objective, the communication strategy, the stakeholders, and the communication methods. The plan is refined with details and schedules for specific activities to be completed by the IC Team to effectively communicate with the stakeholders.

Final Project Report. A final project report will be submitted by the appropriate IC Team upon completion of each LSDDP. The final report will provide a historical summary of the work performed, the technology selection process, the roles and responsibilities of the technology selection committee, and the recommendations and lessons learned from the LSDDP. The Chicago Pile-5 LSDDP Final Project Report is presented in Appendix L.

Deployment

Philosophy and Objectives. The real success of the LSDDPs is measured by the number of innovative/improved technologies that are adopted as the new baseline or commercially deployed in deactivation and decommissioning projects within the DOE weapons complex following successful demonstrations, and the quantifiable benefits that the innovative/improved technologies bring to those projects in terms of cost savings, radiation dose reduction, waste volume reduction, schedule acceleration, and safety improvements.

The DDFA has several avenues for commercial deployment of innovative/improved technologies demonstrated in its LSDDPs. These avenues include, but are not limited to,

- Replacement of the baseline technology with the innovative/improved technology to complete the baseline D&D project hosting the LSDDP. The innovative/improved technology immediately becomes the new baseline technology.

- Innovative/improved technologies are included in proposals from commercial D&D firms on the IC Team and successful bidders use the innovative/improved technologies in deactivation and decommissioning projects in DOE and the private sector.

- The DOE site contractors use the innovative/improved technologies in their deactivation and decomissioning projects.

- The innovative/improved technologies are deployed through DOE's Accelerated Site Technology Deployment projects.

It is the DDFA's intent to actively market and promote the deployment of innovative/improved technologies with demonstrated benefits.

Deployment Factsheets. Periodically, but no less frequent than quarterly, the DDFA intends to contact vendors of innovative/improved technologies that demonstrated their technologies in LSDDPs to track the number of technology deployments resulting from demonstrations in LSDDPs, and the benefits provided by the technology deployments. The DDFA publishes Technology Deployment Factsheets disclosing information on its technology deployments. A sample Technology Deployment Factsheet can be found in Appendix M.

Lessons Learned

The following discussion on lessons learned is not intended to be all inclusive. The discussion is intended to be representative of general lessons learned and areas for improvement based on the performance of the first three LSDDPs.

Project Implementation. The activities of key people, particularly Test Engineers, needs to be carefully scheduled to allow the Test Engineer to conduct the demonstration, analyze demonstration data, and prepare the Technology Demonstration Factsheet, DTR, and ITSR in a short time frame (i.e, 3-4 months) without being unduly diverted to other activities. Overload of key people caused significant delays in preparing Technology Demonstration Factsheets, DTRs, and ITSRs.

Technology Selection. It is important to involve the field workers, health physicists, D&D engineers, and health and safety personnel in the development of technology needs, selection of technologies, and preparation of test plans.

The Technology Selection Process could be improved by including a "back-of-the-envelope" calculation showing the potential cost benefit of the innovative/improved technology compared to the baseline technology.

Selection of innovative/improved technologies should be based on their potential for significant (e.g, >30%) cost savings. "Borderline" baseline technologies and innovative/improved technologies with a potential for only small cost savings (e.g., 5%) should be discouraged for selection for demonstration.

With an increasing number of LSDDPs, it is important for IC Teams to be more agressive in searching and screening international technologies and technologies that have not been applied to radioactively-contaminated environments. IC Team membership by international companies would enhance the IC Team's ability to discover appropriate international technologies.

Technology Demonstration. Prior to the demonstration, it is recommended that the Test Engineer and IC Team establish measurable "success indicators" and "performance goals" for the innovative/improved technology and baseline technology during their demonstrations. Implementation of this recommendation will provide the vendor of the innovative/improved technology with a pre-established performance target to meet or exceed.

Technology demonstrations must have sufficient scope and duration to generate conclusive data for IC Team members to decide on the merits of the innovative/improved and baseline technology. The duration of the demonstration should allow for an initial startup period to overcome the "learning curve" for the innovative/improved technology and to attain a realistic production rate and performance for the technology. A typical demonstration, including mobilization, demonstration, and demobilization, should last one to four weeks depending on the technology.

All technology demonstrations should be videotaped because valuable data can be obtained from the videotape which may not have been recorded during the demonstration. Work crew debriefings also provide valuable information on technology performance, including recommendations for technology design and operation improvements. It is important to use experienced, trained people to record data during the demonstration.

A side-by-side demonstration of the innovative/improved and baseline technologies on comparable work areas provides the most meaningful data, and should be arranged whenever possible.

For demonstrations involving technologies that have not been applied to radioactively-contaminated environments, the Test Engineer needs to interact more closely and further in

advance with the technology vendor to ensure that the technology is "field ready" for demonstration.

It is important to provide incentives to justify the requirement for technology vendors to cost-share in the demonstration of their innovative/improved technology. The main incentive is to have an option in their contract for guaranteed additional fee-bearing work if their technology is proven to be superior to the baseline technology during the demonstration.

Data Analysis. The IC Team and Test Engineer need to interact more closely with the Cost Engineer from the USACE in jointly reviewing demonstration data, making assumptions, and deciding on performance values for inserting into the MCACES cost model. Cost data needs to be reported in a consistent manner in each ITSR (e.g., unit costs, break-even curves, cost drivers, cost versus job size).

Communications/Documentation. The ITSR should be generated in a more timely fashion, preferably within three months after the demonstration. The quality of draft ITSRs could be improved through more specific guidance on preparation of ITSRs and a more concentrated, short-term effort by the Test Engineer on analyzing demonstration data, and writing DTRs and ITSRs following a completed demonstration. The technology vendor should be given an opportunity to review the ITSR prior to publication.

The Test Engineer that witnessed the demonstration should prepare the Technology Demonstration Factsheet, DTR, and ITSR.

Technology Deployment. With the success of the innovative/improved technologies demonstrated in the LSDDPs, the DDFA needs to develop a sound, cost-effective strategy to deploy these technologies at DOE and commercial sites.

LSDDP Lessons Learned Meeting
West Valley Demonstration Project
October 9, 2001

Introduction

A comprehensive Lessons Learned Meeting was held at the West Valley Demonstration Project (WVDP) site on October 9, 2001. This meeting was an opportunity for the three concluding Large Scale Demonstration and Deployment Projects (LSDDPs) to share their LSDDP experiences, both positive and negative, with members of the new WVDP Ho Cell D&D LSDDP. The three concluding LSDDP projects participating were the Idaho National Engineering and Environmental (INEEL) Fuel Pools and Associated Structures D&D, the Los Alamos National Laboratory (LANL) TRU Material Disposition, and the Mound Tritium Facility D&D. Each had several key people from their Integrating Contractor Teams (ICT) sharing information in a format and content determined by the Deactivation and Decommissioning Focus Area (DDFA). Members from the new at WVDP Hot Cell D&D LSDDP were present to capture the information provided and to ask questions. While the overall program objectives were the same for each of the three concluding projects, each implemented unique approaches to achieve these objectives.

DOE/NETL DDFA Senior Management & Technical Advisor, Steve Bossart, opened the meeting by outlining the day's agenda and establishing the presentation ground rules. In attendance were ICT representatives for each of the three concluding LSDDPs at INEEL, LANL, and Mound. Also participating were ICT members from each ICT organization for the new WVDP Hot Cell D&D LSDDP. The WVDP ICT includes West Valley Nuclear Services, PNNL, Fluor Hanford, Battelle Columbus, Scientech, Inc., and Washington Group, Inc. Other organizations participating included the U.S. Army Corps of Engineers (USACE), Florida International University, DOE/West Valley and DOE/NETL. Approximately 25 people were in attendance. Attachment 1 is a list of those in attendance.

The meeting was organized into six modules covering the following topics:

- LSDDP Implementation
- Technology Selection Process
- Technology Demonstration Process
- Post-Demonstration Data Analysis
- Communications/Documentation
- Technology Deployment

The topics covered in each module were provided to the presenting LSDDPs prior to the meeting and are included in the meeting agenda (Attachment 2). The following sections highlight the information presented during each module. Lessons learned and issues raised during the question and answer period are also included in the following sections. Presentation materials are included as an appendix to this document.

Module 1 – LSDDP Implementation

The INEEL LSDDP led off this session. The theme conveyed by INEEL in this session and throughout the day was clear and open communication and coordination between ICT members and other project team members. INEEL felt that this was the key ingredient to the success of their LSDDP. For example, INEEL pointed to the critical need to incorporate the U.S. Army Corp of Engineers (USACE) into decisions on data collection requirements early in the demonstration effort. INEEL encouraged the new WVDP ICT to get members engaged early so that they feel a part of the project and thus, are committed to see the project succeed. All the Team Members (not just the ICT) are the key to success. Also, support from the D&D Operations staff was seen as critical to success.

Lessons Learned - INEEL

- The kick-off meeting is key to establishing a team feeling, good lines of communication and rules of conduct for the ICT
- Phone calls worked better than meetings and allowed for changing directions faster and easier. Calls were more frequent at the beginning (particularly during technology review/selection) – once per week. Approximately, every two weeks after and about once per month towards the later stages.
- Phone calls should be documented
- Phone calls are much less expensive, but face-to-face meetings do have some advantages; an alternative may be video conferences

The Mound LSDDP presented second during this first module. The presentation highlighted the ICT roles, responsibility and communication. Communicated by teleconferences (2 per month) and meetings (3per year). Mound discussed the difficulties with different levels of participation by ICT members. Also discussed was the difficulty placing contracts with ICT member companies, which often led to long delays. Finally, Mound discussed the challenge of integrating an LSDDP demonstration into a Closure project's baseline D&D schedule such as at Mound. Without support by baseline project personnel, the LSDDP would have been less successful.

Lessons Learned - Mound

- Tracking and controlling costs with the ICT and demonstrations can be difficult
- Administrative costs can become substantial; watch overhead rates
- The ICT can be too large and members may not participate at the same level
- Baseline project personnel must be supportive of the LSDDP

The final presentation was by LANL. LANL described the roles and responsibilities of the ICT, which consisted of a Technology Selection Committee and a Management Committee. The Management Committee made final approval of demonstrations into the baseline project and approved budgets. It was recommended that this committee should be kept small and that the vital role for this group should be to gain acceptance and cooperation from baseline project personnel for the demonstration of innovative technologies.

Lessons Learned – LANL

- Acceptance by baseline project management is important
- Make sure the project is aware of stakeholders and their perceptions
- Keep the "Management Committee" small. At the start of the project, this activity was found be to utilizing an inordinate amount of project resources and adjustments were needed to better integrate "management" and "Team" functions.
- Be prepared for the project to unfold differently than originally envisioned

Questions

Is EPRI a resource that was used? Generally no, but they do have information on technologies that may be candidates for technologies. Unless someone on the ICT is a member though this information may be hard to come by.

Are the LSDDPs encourage to demonstrate international technologies? Yes to the extent possible, but these are much more complex to implement and often times more costly.

Module 2 – Technology Selection Process

Mound began the second module. The Mound ICT began the Technology Selection Process by identifying needs in cooperation with the site baseline D&D personnel. Mound utilized technology databases as well as a Commerce Business Daily (CBD) call for technologies to identify potential technologies for demonstration. Mound expressed that if the CBD was used, it is important to identify needs very early in the LSDDP implementation process, as it can take time to get a call out, contract with vendors and demonstrate. Also, though the CBD was used, ICT members brought most technologies to the LSDDP. Technology evaluation criteria included is the technology already a baseline, does it meet Mound or other needs, is it ready for demonstration and the cost and potential cost savings. Selection followed a standard screening process.

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Lessons Learned – Mound

- It is important to look outside DOE and at non-nuclear commercial vendors for possible technologies
- International technologies are a plus but often complicated by bureaucracy
- Beware of technology vendor information and claims; the information may be exaggerated
- Vendor cited demonstrations often are not representative of actual field conditions
- Vendor participation is directly related to the size of the market
- Technologies proposed for demonstration may correspond with the baseline D&D project's needs at the time.

LANL also incorporated site personnel into their needs definition process. Additionally, LANL invited other sites with similar problems to contribute to the needs definition process. Primarily, ICT members brought technologies for evaluation, although internet searches and FIU related technologies/information were also used. The CBD process was used but required a fair amount of effort for little or no tangible results in this case.

Some "Go/ No-Go" criteria were used in evaluation including safety authorizations, readiness for demonstration and the size of the technology (is it too big or complex to demonstrate practically). Also, used the "standard" LSDDP evaluation criteria such as can more than one DOE site use it, better than baseline, cost reduction, cost of demonstrating, reduction in worker health and safety risks, ability to gather valuable information on the technology. At first LANL voted on technology selection, but later went to a consensus approach. Another key observation by LANL was that as the baseline project changes, so may the needs and the requirements for innovative technologies. Ultimately, the technologies selected from those being evaluated were those that the site would "buy in" to demonstrate.

Lessons Learned - LANL

- Part-time personnel on the ICT had limited success in finding technologies for demonstration
- Technology selection were based ultimately on what LANL wanted and what fit into the baseline schedule
- The Technology Selection Committee should identify more technologies than ultimately demonstrated to provide flexibility and availability of alternate demonstration technologies in case originally anticipated demonstration opportunities do not materialize as expected/planned.

INEEL discussed the importance of "documenting" technology needs and integrating these needs into the formalized needs process established by the Office of Science and Technology. Also emphasized was the need to fully document the technology screening and evaluation process in the event the ICT needs to review past decisions for any reason. The Team Members were the most important source of technology identification. Some technologies were identified from contacts with vendors at trade shows. Technology clearinghouses (i.e., websites at FIU, NETL, LSDDPs) were researched as were U.S. and foreign D&D operations experiences. INEEL recommended that more technologies than required for demonstration be screened and approved thereby allowing for any unforeseen delays or cancellations in planned demonstrations. Recommended developing/discussing selection criteria at the kick-off meeting and using a two step ICT evaluation (pre-screen and a detailed evaluation) using a form for both steps. INEEL noted that regardless of what technology the ICT may select and plan to demonstrate, the D&D Operations schedule can shut down potential demonstrations. Further, INEEL suggested that the decision to demonstrate a technology should be based on a majority ICT vote not a unanimous vote. Recommended assigning a mentor/advocate to each technology to help assure that the technology, once selected, will actually get demonstrated.

Lessons Learned - INEEL

- Assign a mentor/advocate to each technology
- Avoid big, complex, expensive technologies
- Look hard and everywhere for technologies
- Look for technologies with high potential for deployment
- Make sure technologies are mature and do not require further development

- Demonstrations of foreign technologies are more expensive
- Encourage vendor cooperation and participation

Questions
Do all technologies screened have to show a potential cost savings? Cost savings is important, but DDFA recognizes that some technologies may be enabling and other may have little cost advantage but are much safer or can enhance baseline schedules compared to baseline technologies.

Is there a preference to sole source versus a competitive call for potential technologies for demonstration? Competition is encouraged but is not required. There are times when a specific vendor technology is desired and though sole source contracts may have to be justified; they are the right path to take. If a general technology is of interest, it may be best to go out for a competitive call to determine the pros and cons of a particular technology and/or vendor. Also, you may want to demonstrate a set of competing technologies, which can be enhanced by a competitive call. The key is to avoid biases toward certain vendors and issues associated with sole sourcing.

Was the CBD process beneficial? All three LSDDP projects concluded that doing a CBD announcement was a logical method to potentially identify innovative technologies and did not require a significant amount of effort to issue. However, none cited substantial direct results from using the process. Each LSDDP concluded that the Team Members were the single best source for identifying innovative technologies.

Module 3 – Technology Demonstration Process

LANL began the presentations for this module. LANL negotiated sole source contracts with vendors and pursued use of the equipment or a vendor service s to demonstrate their equipment (at no cost, if possible). The Test Plans followed the DDFA format and determined the objectives, variables for data collection / monitoring, requirements (e.g., EH&S, authorization basis, training, support services), necessary materials and services. Involvement of both the site contractor and the vendor is essential. Conduct of Operations was implemented to orient and qualify vendors for training, procedures, health and safety plans, and other items necessary to fulfill authorization basis requirements. The site contractor will, as at LANL, have final approval for the demonstration. A Test Engineer collected data on site and also provided full time oversight. Make sure all Operations requirements are satisfied before the vendor arrives onsite, because work will not start without it and otherwise will likely result in significant delays and costs to the LSDDP.

Lessons Learned – LANL
- Conduct of Operations requirements take time; start them early
- Conducting demonstrations off-site was not a problem
- High site interest in the LSDDP help to promote the project. This was fostered by presentations to showcase the innovative technology.

- Contractor agreements between site personnel and the vendors are important and need to be settled up front. Plan on the site wanting direct control over the vendor.

INEEL considered the test plan as the key ingredient of a successful demonstration. INEEL suggested that the first test plan should be reviewed with an exceptionally critical eye so that subsequent test plans can be developed easier and faster. According to INEEL, a well-developed test plan can be used to develop demonstration fact sheets and Innovative Technology Summary Reports (ITSR). When developing a test plan the LSDDP should confer with the USACE to determine what data they will need to conduct the cost and performance analysis (e.g., number of samples, how often to record data and the proper units of measure). Determining this information up front will result in a smoother demonstration and will avoid the need to return to re-demonstrate for additional data or the unavailability of actual data, which may be needed to perform a well-supported analysis. The test plan, according to INEEL, should clearly describe the details of the demonstration and the demonstration objectives as well as all resources required to perform the demonstration. Have the USACE and the vendor review the test plan before it is finalized to get their feedback and to incorporate their knowledge into the plan

INEEL noted that sufficient time must be allocated in the planing process to have equipment delivered to the site, particularly for foreign technologies. The use of a separate person to perform the roles of Test Engineer and Data Collector was strongly recommended. If one person performs both functions, both functions may suffer, as demonstration issues often need to be addressed in conjunction with the actual performance of the demonstration. Also, whenever possible attempt to have one individual serve as the data collector for all the demonstrations.

INEEL recommended having D&D Operations involved in the LSDDP process as much as possible, particularly the demonstration process, since their cooperation is essential to the project's success. A genuine interest in performing the demonstration by D&D Operations will enhance the likelihood of a successful test. Operations "buy in" will also increase the ability of the LSDDP to obtain cost sharing from D&D Operations, which is important to increase the effectiveness of the LSDDP budget. Vendor cost sharing in the form of reducing the cost to purchase the equipment was favored over "lending" the equipment for free. Equipment purchase makes the equipment readily available to the site for immediate deployment following the demonstration. INEEL's approach assumes a high confidence level that the technology will prove to be an improvement over the baseline and that the total purchase price will be within reason compared to the overall LSDDP budget. This assumes a relatively inexpensive technology cost.

INEEL also favored sole source procurements over competitive ones for several reasons including a shorter procurement schedule, the opportunity for personal negotiation with the vendor, more certainty that what is finally proposed/accepted is what is, and overall better flexibility in the demonstration/procurement process. Other topics discussed included the need to get the technology to the site early in case of any last minute schedule problems, the use of persons other than the test engineer to collect data, the

preference to use the same data collector for all demonstrations and the necessity for cost sharing not only by the vendor but also by the D&D operations.

Lessons Learned – INEEL

- Need to plan ahead and be flexible in your plan. Establishing a process that accomplishes both of these will significantly improve the probability of a demonstration success.

Mound's demonstrations were all sole sourced and all vendors provided some degree of cost sharing with equipment and/or labor. A complex site-review process approved all the demonstrations. The site staff performed most of the demonstrations conducted at Mound. However, several demonstrations were conducted at sites other than Mound. The Test Plans adopted a standard format that was consistent with the DDFA LSDDP guidance regardless of the site where the demonstration was conducted. Proprietary issues were a consideration in most demonstrations, but did not present a problem.

Lessons Learned – Mound

- Some technologies were not field ready and required some R&D; this is both time and cost consuming
- The onsite review process was very burdensome and time consuming
- Off-site demonstrations expanded the technology suite but were difficult to manage
- Data collection is a full-time position
- Raw demonstration data should be compiled, cleaned-up and annotated soon after the demonstration is complete

Questions

Are non-rad demonstrations acceptable during a LSDDP? Pre-demonstration mock up testing is acceptable, but these should be followed up by a full-scale demonstration in a radiation environment. Some exceptions have been made for demonstrating in a non-rad environment. For example, the Mega-Tech hydraulic shears were demonstrated at Florida International University. This demonstration was set up so that it was as similar as possible with a full-scale rad demonstration.

Pre-demonstration mock up testing may be very important at West Valley since equipment contamination and the ease of returning equipment may be a serious issue. Ease of decontamination may need to be a more important factor in determining which technologies can/should be demonstrated at West Valley.

Module 4 – Post-Demonstration Data Analysis

This session opened with a presentation by the U.S. Army Corps of Engineers (USACE). Since the inception of the LSDDPs, the DDFA has utilized the USACE as an independent third party, with no vested interest in the outcome, to conduct cost analyses for the demonstrated technologies. The USACE provided lessons learned on essential activities prior to, during and subsequent to the demonstration. Some key lessons learned include:

- Demonstrations should, if possible, be conducted for a minimum of ten days to determine adequate production rates. The demonstrations are often for shorter lengths of time, but adequate data (type and quantity over a reasonable period of time) is still needed to reasonably support any statements regarding the cost and effectiveness of the technology.
- Standardized data collection forms and methods for each demonstration and site will improve organization and minimize delays in analyzing cost and performance. The various sites in past LSDDPs have not usually used standardized forms, but the USACE (e.g., Buffalo District) has standardized forms available. Appropriate Units of Measure must be determined in planning for the demonstration (square feet to be cleaned) that will serve as the basis for measuring the cost effectiveness of the technology and, also, as a comparison to the baseline.
- Procurement method for the technology must be known for accurate cost analysis (i.e., vendor provided service, leased or purchased equipment)
- Market size estimate will assist in determining technology total cost savings
- Complete daily log sheets as demonstration is conducted and fax first day's results to COE for review and comments
- Raw data should be provided to the USACE not revised "massaged" data.

Other lessons learned are provided in the USACE's presentation in the appendix. The presentations also addressed general items to be included in data collection forms.

INEEL followed the USACE and generally echoed the lessons learned outlined by them. Specifically, INEEL emphasized the need for continuous communication with the USACE including providing a schedule for supplying data to the USACE, so they can schedule their resources. They recommend a single point of contact and face-to-face meetings with the USACE in order to develop a firm relationship and to ensure that expectations are the same. INEEL stressed the need for reviewing the test plan to ensure all data and data objectives were achieved. INEEL also recommended that the D&D workers be interviewed to determine non-quantifiable technology attributes such as ergonomics, user friendliness, etc.

<u>Lessons Learned – INEEL</u>

- Communicate and Plan. This includes keeping the USACE as well informed as possible on the anticipated demonstration schedule.

Mound expressed that cost is usually the most important consideration if the technology performance is equal to or better than the baseline. Mound staff worked with the USACE to develop the cost data.

<u>Lessons Learned – Mound</u>

- Baseline technologies and costs were often difficult to identify/quantify
- The technology's costs were sometimes subjective
- The USACE process was sometimes perceived as too rigid by the ICT
- The cost basis of a technology versus the actual demo cost can sometimes be confusing. Need to focus on what the actual costs to deploy the technology in the

field were not costs incurred solely because of the demonstration aspect of the technology use.

LANL presented last in this module and the main theme that they expressed was that cost is not the only important factor for determining the benefit of a technology. Risk and schedule reduction can have as great or even greater importance than cost. As with INEEL, LANL suggested that the reaction of the personnel operating the technology should be captured.

Lessons Learned – LANL

- Cost scenarios need to be considered during the Test Plan development
- The USACE response was often slower than the ICT had anticipated. This highlights the need for good planning and communication by all parties.

Questions

There was some concern about the responsiveness of the USACE. It was made clear that communication and up front planning with the USACE, can go a long way toward increasing the efficiency and response time for the COE cost analyses.

How should costs savings be calculated; unit cost savings or life cycle cost (LCC) savings? Typically, the extent of the market is not well known so the determination of LCC can be difficult. Most cost savings for LSDDP demonstrated technologies have focused on the unit cost savings compared to the baseline technology. In many cases, a break-even analysis can be generated to determine when a technology will provide a cost advantage.

Questions were also raised regarding what costs should be included in the technology costs. Some costs associated with the demonstration are not valid costs for calculating costs (e.g., costs associated with screening/evaluating the technology and costs associated with documenting the demonstration cost and performance). The costs that should be included are those that would be accrued in a future deployment of the technology such as mobilization, implementation, and demobilization. The USACE stated that cost calculations need to take into account the actual cost of discounted or cost shared items during the demonstration. In summary, the cost savings needs to reflect an actual use of the technology in a real-world setting.

How is dose reduction calculated into the cost savings? Each site has a different value for dose exposure. If possible, this should be built into the calculations. However, this is not always possible and often the dose reduction aspects are reported separate from the technology cost savings.

How are the LSDDPs able to have the workers not alter their work habits knowing that the technology is being demonstrated for cost and performance? The USACE commented that the best way to take this into account is to have demonstrations that last long enough so that average work conditions are met.

Module 5 - Communications/Documentation

Mound followed the LSDDP communications guidance maintaining documentation of teleconferences, technology screening and evaluation, demonstration fact sheets and Innovative Technology Summary Reports. Mound used the standard LSDDP guidance by communicating through fact sheets, ITSRs, web site, conferences, and public forums. The demonstration fact sheets proved to be a very effective tool for getting information out quickly and conferences, such as Waste Management and SPECTRUM, provided good exposure for the LSDDP. Mound noted that the Test Engineer wrote the Detailed Technology Report (DTR), but someone else (usually someone who did not witness nor have any other direct knowledge of the demonstration) wrote the ITSR based on the DTR. This can lead to difficulties in getting a timely, accurate and cost effective product.

Lessons Learned – Mound

- Some videos of the demonstrations were developed but they were more difficult to produce and less effective than pictures
- The ITSRs always took longer to develop than planned
- Transmitting large volumes of data, text and pictures between ICT members is problematic; suggest developing a file transfer protocol (ftp) site for file transfer between members

LANL effectively used the teleconferences and the LSDDP homepage as the primary tools for communication. The teleconferences were documented and minutes were distributed to all participants. The web site has had 7,800 visits since 1998 and LANL felt that the photo gallery and technology reports provided an effective means of transferring data to other interested sites. LANL presented papers at conferences such as the Technical Information Exchange Workshop, Waste Management, and Spectrum. The Test Engineer authored the Demonstration Fact Sheets and the ITSRs, which worked well as long as other assigned site tasks did not preclude that individual from completing the documents in a timely manner.

Lessons Learned – LANL

- The conference booth had special appeal to only certain sites, so there was only limited interest
- The review of ITSRs and other documents was somewhat cumbersome because of the LANL review process often resulting in less than timely communication of results
- Web sites are effective in getting the word out quickly
- Teleconferences are a good means to generate interest among participants

The first presentation slide by INEEL summed up the essence of their view, "Communication and documentation are the key elements to LSDDP success". INEEL emphasized the importance of not overlooking or underestimating this portion of the project. They used a variety of communication mediums including Fact Sheets, ITSRs, Team Conference calls, individual calls, CDs, videos, web site, business cards, technical presentations, trade shows, local newspaper &TV, and other publications. INEEL also emphasized that demonstration documents (fact sheets, ITSRs, etc) need to be well

written, concise and timely. Having a technical writer review and revise the draft written by the technical expert (i.e., Test Engineer) can sometimes facilitate this. Further, they recognized that if early planning and documentation (e.g., selection/evaluation forms and test plans) are well prepared and written, then much of the post-demonstration documentation could be pre-written.

Lessons Learned – INEEL

- Success is useless unless effectively communicated so other potential end users are made aware of the technology. Obtaining and communicating this information to others is a primary reason for doing the demonstration
- Milestones should be draft documents as there is limited control over final document and schedule (e.g., ITSRs)
- Provide more rather than less information; it can always be edited down
- Keep records of all communications and documentation including meeting minutes, screening/evaluation forms, presentations, publications, deployment records and needs status/resolution updates

Questions

What did the LSDDPs find to be the most effective communication tool? All communication tools were found to be effective if packaged well and if provided in a timely manner.

Module 6 – Technology Deployment

LANL felt that customer commitment was vital to promoting deployments. This requires personal contact with end-users and the ability to show significant benefit of the innovative technology, especially cost savings. A key benefit of the LANL LSDDP was the fact that there is a baseline activity underway in parallel with the LSDDP. This allowed ownership of the LSDDP by LANL personnel involved in the Decontamination and Volume Reduction System (DVRS). Another aspect of the LSDDP success and deployment of improved technologies is that a number of sites (e.g., Hanford, Rocky Flats, and Savannah River) have similar problems. Rocky Flats actually participated routinely on the LANL LSDDP conference calls.

Lessons Learned – LANL

- Must capture interest by the baseline D&D personnel prior to demonstrating the technologies in order to be effective with deployments
- Good technologies need little promotion and are quickly identified and used

INEEL recognized that deployment of new technologies requires effort, but identified a number of key elements that can help to promote deployments. These include technologies that are needs driven particularly at multiple sites, technologies that are not too complex or costly, and technologies that are readily (commercially) available. INEEL worked onsite to establish deployments following the demonstration, which required a technology advocate and effective communication with site end users. Ultimately, the end user must have a need for the technology and the technology must

show benefit (e.g., cost, schedule, or safety advantage). INEEL technology advocates worked to make sure the technologies were on site and available, and if necessary, addressed training, certification and acceptance issues with the end user. INEEL also recognized the importance of tracking deployments subsequent to the demonstration. Deployments represent a key metric by which the Focus Area and the Office of Science and Technology are measured. INEEL integrated demonstration and deployment activities with the Site Technology Coordination Group representatives to ensure all deployments were properly tracked, reported, and documented.

Lessons Learned – INEEL

- A single set of criteria is needed for identifying deployments
- Demonstrate highly deployable, cost-effective technologies
- Look for follow on deployments; produce and make available refresher training fact sheets or videos to help future users of the technology
- Be patient, they don't always come quickly because it can take time for information to disseminate
- Identify, track, record, and report all deployments; checking with the technology vendor for information on later deployments is one part of the approach to use

Mound had an aggressive program for deploying technologies utilizing strong links to other sites in the complex. A dedicated staff role was established to seek out and encourage technology deployments.

Lessons Learned – Mound

- One successfully deployed technology can justify the entire LSDDP
- Successful demonstrations do not necessarily result in deployments after the demonstration
- Supporting deployments at non-host sites can be difficult
- Counting deployments is subjective.
- Connected with Focus Areas and site STCGs to promote deployments

Questions

Does DDFA value deployments as highly as demonstrations for the West Valley LSDDP? The West Valley project is a Model A LSDDP, which by definition emphasizes demonstrations. However, subsequent deployments of demonstrated technologies can be conducted (i.e., funded) within the WVDP LSDDP. The primary focus of the WVDP LSDDP should be on validating (i.e., demonstrating) the cost and performance of innovative technologies for the D&D of hot cell facilities.

Also discussed during this question and answer period included the fact that the D&D technology loan program has been re-instituted. Dave Yannetel at WSRC is the point of contact. INEEL also discussed that if training is required to operate innovative technologies, it is very useful to develop a brief operations training guide including fact sheets and a video. For deployments that occur some time after the initial demonstration such a guide could be quite useful in reacquainting the operators with the technology.